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East Europe Report

SCIENTIFIC AFFAIRS

No. 677



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INTERNATIONAL AFFAIRS

ROBOTRON GOLD MEDAL PRODUCTS AT LEIPZIG

Budapest SZAMITASTECHNIKA in Hungarian Mar 80 p 1

[Article by Dr Ivan Szabo: "The Gold Medal Computer Technology Products of Robotron at Leipzig"]

[Text] Two computer technology products of Robotron, the S 6001 typewriter and the K 1600 microcomputer system, won gold medals at the first large exhibit of 1980 introducing computer technology devices. The two devices are among 39 new pieces of Robotron equipment which raise the number of Robotron products to 104.

The S 6001 electronic typewriter based on a K 1520 microprocessor opens a new epoch in writing technology. The claim of the exhibitors that they have realized the dream of typists seems justified. We should mention only a few of its use advantages to give a feeling for the possibilities of this device which realizes truly magnificent functions:

--automatic correction in typing,

--use of the correction key to erase the character to be corrected from the paper and from the text storage of the typewriter,

--automatic paper advance which permits optional placement of the paper and provides for starting the typing at a place according to the programmed margin independent of the placement,

--automatic and simultaneous underlining,

--automatic typing of numbers in the correct place value,

--automatic paragraphing,

--the possibility of calling up five different programmed table formats with vertical and horizontal lines and columns for the table,

--4 K byte text storage which makes it possible to call up previously typed so-called canned text at will,

--automatic marginning during repeated typing of representative texts, and

--suitability for the most varied letter and writing forms and satisfying printing and composing requirements.

It has a set of 96 characters, a writing speed of 30 characters per second, and a "daisy wheel" writing technology via margin setting software and optoelectronics. The work of the typist is also aided by a place value numeric indicator and by optical and acoustic signaling.

The K 1600 microcomputer system is compatible with the SZM-3 and SZM-4 models via its instruction list. The system can be expanded modularily.

It is offered for the following applications areas:

--automated manufacturing control,

--automation of laboratory testing and measuring sites,

--scientific-technical and economic calculations,

--data collection,

--data transmission control, and

--guidance and supervision of non-producing branches.

Its peripherals integrate a large number of devices manufactured by the GDR, Hungary, Bulgaria, Poland and Czechoslovakia as follows:

punch card reader, punch tape reader, cassette magnetic tape unit, floppy disc, sequential writer, line printer, magnetic tape unit, fixed disc storage, cassette disc storage, I/O equipment for process guidance and control, and an alphanumeric keyboard. Its TAF (remote data processing) peripherals are: modes, multiplexor, I/O screen unit, terminal, and telex. Its translator programs are: PASCAL, BASIC and FORTRAN. The number of bits which can be processed simultaneously is 16 and its processing mode is parallel. Its storage capacity is from 28 to 124 K words.

Although it is not a computer technology device we should mention that the MS 1843/M instrument of the Instrument Industry Research Institute (MIKI) for testing microprocessor layer thickness won a gold medal at the exhibit of the Hungarian instrument industry. This instrument measures the thickness and layer growth speed of metal layers formed by vaporization in a vacuum.

The device is at the world level in regard to its technical quality and according to information received from Perenc Palotai, the representative of the enterprise, it is competitive with products of Balzers in Lichtenstein, the FRG Reybold-Heraeus and the American Sloan and AIRCO.

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INTERNATIONAL AFFAIRS

MAJOR OPERATING PRINCIPLES OF THE ESR-2 SERIES

Budapest SZAMITASTECHNIKA in Hungarian Mar 80 p 4

[Article by Dr Ferenc Gemes: "The ESR-2 Series; More Important Operating Principles, V]

[Text] In the concluding part of our series the reader can get a picture of the more important versions of the input-output system.

There can be no doubt that the appearance of the block multiplex channel represents the greatest change in the input-output system. The operation of multiplex channels is known from the models of the ESR-1 series. The essence of this is that with the input of a sub-channel word the multiplex channel transmits a data byte to or from the addressed device. The many sub-channels included in the multiplex channel made it possible for the slow operating peripherals belonging to the computer to operate at virtually the same time. This type of channel remains with the ESR-2 series under the name byte-multiplex channel, in reference to its mode of operation.

The method of data movement on the block multiplex channel is similar to the foregoing with the difference that after the input of a sub-channel word there is the transmission of several hundred or several thousand data bytes. This method of operation was known with the selector channel of the ESR-1 series. But the selector channels did not have sub-channels whereas the block multiplex channel can have 128-256 sub-channels. Since it is not necessary to constantly put in the addresses contained in the sub-channel word the transmission performance increases, satisfying the requirements of fast operating peripherals too. The block multiplex channel makes possible the realization of multiprogramming, at least to a certain extent, at the level of the channel programs. This means that it is possible to execute the data transmission operations of one channel program while executing the operations of another channel program which have no data transmission. This mode of operation is especially important with magnetic disc units where positioning operations requiring a long time and very fast data transmission operations frequently follow one after another.

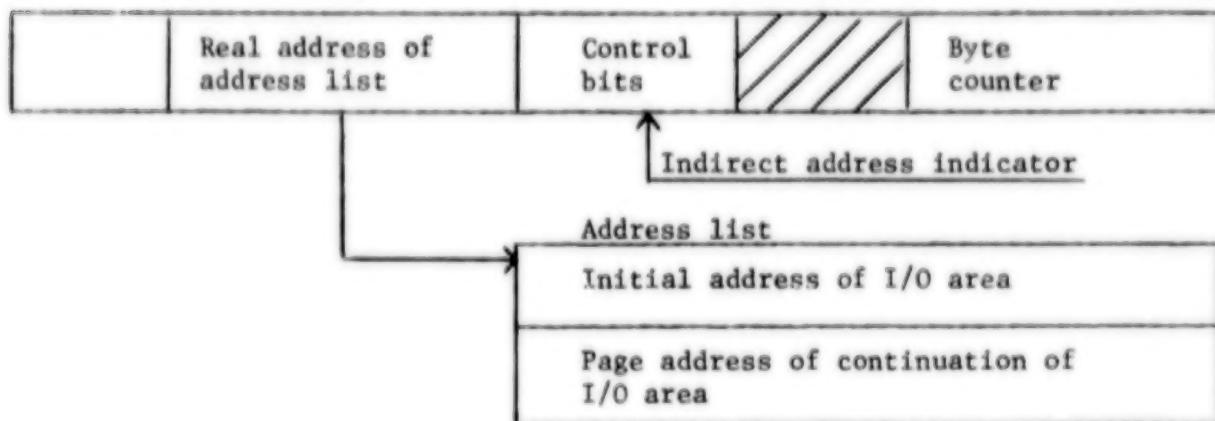
The introduction of the virtual storage technique required changes in the channel instruction word too. As is well known the data address which can be found in the channel instruction (CCW) signifies the address in basic memory of the data being moved (see diagram 12). In the new system it had to be decided whether the address in the channel instruction should be real or virtual. Because of the large time requirement for explicit address transformation it was not appropriate to use a virtual address. But in using a real address one has to reckon with the fact that the I/O operation may extend to several memory pages which at any given moment may be found in different places in real memory.

Diagram 12. Indirect addressing

Channel instruction word (CCW)

0

63



In the models of the ESR-2 series there is a new interpretation in addition to the old interpretation of the data address of the channel word. With the new interpretation an address list is compiled in memory which contains the real address of all the memory pages affected in the I/O operation. In this case the CCW contains the real address of the address list (diagram 12). This method is indirect data addressing. A flag bit (IDA bit) previously unused indicates whether the channel instruction word contains a direct or indirect data address.

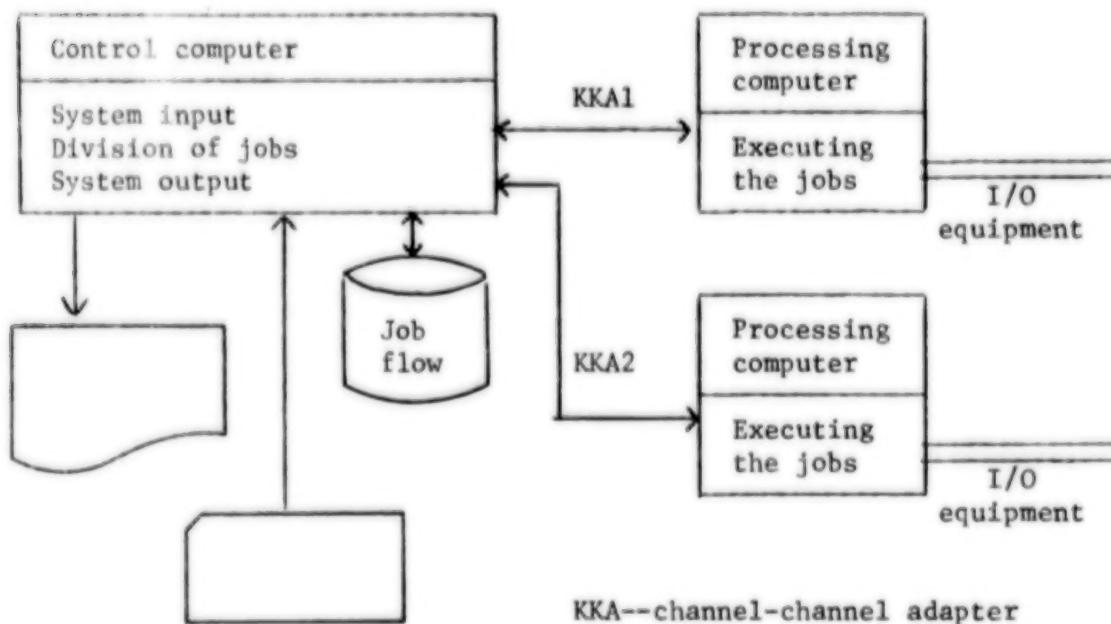
In the ESR-2 series a new channel program initiation instruction was introduced in the interest of decreasing the load on the central unit. A large part of the time requirement of the old START I/O (SIO) instruction was taken up by checking to see if the data line to the equipment was free. In the great majority of cases the line to the peripherals is free so it was better to free the central processing unit of having to perform this check. For this purpose they developed the SIOF instruction (START I/O with fast freeing). If the data line is occupied there is an interruption of the I/O program.

In the interest of accelerating data transmission they expanded the standard interface (SIF) in the ESR-2 series. As a result there is a possibility for 2 byte parallel transmission with fast operating peripherals and this doubles channel performance.

We find a number of new devices in the models of the ESR-2 series at the end of the channel next to the central unit. Of these, it is the task of the central channel part to work with the base memory adapter, the channels and the central control unit. In this way, among other things, it executes all those operations which become necessary because of channel data transmission by byte or by two bytes or because of the double word length data transmission width of the memory adapter.

The channel-channel adapter is a supplementary device. With its aid it is possible to carry out fast data exchange between two central units and thus to build up machine complexes consisting of several central units. There are hardware and software problems in developing multi-machine complexes. Diagram 13 shows the block diagram of a three machine system which can be developed using the channel-channel adapter.

Diagram 13. A multi-computer complex



By using a direct link (DSI) it is possible to connect to the central control unit, for example, the newly developed matrix module with which one can greatly decrease the time needed to execute matrix operations.

The characteristics of the ESR-2 series which have been described prove that the operational principles of computers have changed much in the past 10 years. In addition to increasing performance data the many efforts which have been made in the interest of increasing the reliability of the

machines are especially significant. In this article we have not dealt with many other hardware modifications (console, emulator, etc.), with the new high performance peripherals (100-200 M byte magnetic discs) or with the improved operation control systems. We should prepare in time to receive all these so that we will have successfully operating systems in the hands of understanding and creative users.

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INTERNATIONAL AFFAIRS

FUNCTION OF ESR READERS, PUNCHES DESCRIBED, EXPLAINED

Budapest 97 MITASTECHNIKA in Hungarian Mar 80 p 6

[Article by Peter Keszthelyi: "ESR Readers, Punches"]

[Text] In the previous issue we dealt with line printers among the peripherals of the ESR computers. We want to add two things to that article:

--An article by Gy. Tomanyi and F. Zilahy titled "Accented Characters" in the March 1978 issue of INFORMACIO-ELEKTRONIKA deals in more detail with the problems of accented Hungarian characters. (It must be noted that contrary to the assertion of the article an accented character drum was not used on the ES-7032.)

--The ESR computers have two sorts of channels--selector and multiplex channels. On the selector channel the information exchange is with only one peripheral until all the information is transmitted; on the multiplex channel there is information exchange with several peripherals. After selection of the peripherals they are disconnected from the channel and then they occupy a channel with the transmission of a service request of one byte (or rarely a few bytes). The service requests are accepted according to an order of priority. In accordance with the foregoing the fast peripherals (magnetic disc, magnetic tape, etc. units) are connected to the selector channel and the slow peripherals are connected to the multiplex channel. It must be noted that the standard connecting units of the slow peripherals are also capable of operating on the selector channel and it is possible to operate them on the multiplex channel in a selector mode; this is called burst operation. In this case the peripheral forces the multiplex channel to "deal" only with it until all the information is transmitted.

In this issue we will report on additional slow (multiplex) peripherals--punch card and punch tape equipment. We will deal only with that punch card equipment which has standard connecting units, with readers and punches.

Punch Card Readers

Of the ESR peripherals we are acquainted with three types of punch card readers in our homeland, the ES-6012, the ES-6016 and the ES-6019. The ES-6012 is most generally used in our homeland. This is now being replaced by a new type, the ES-6019, also of Soviet manufacture. The ES-6016 (a Czechoslovak product) is primarily a part of ES-1040 computer configurations.

Punch card readers read information on standard size punch cards (45, 80 and sometimes 90 columns) by column by photoelectric means. The information is recorded on the cards in coded form using the KPK-12 code (12 pozitsionnovo koda perfokarti) or binarily. The electronics of the reader recodes the information read in the KPK-12 code into the standard DK01 (Dvoichnovo koda dilya obrabotki informatsiya) code of the channel and sends it on into the channel with the aid of a standard linking unit. Binary information is passed on without coding.

In general the cards are advanced mechanically with a knife feeder. This solution is very sensitive to the perfectness of the cards. A bent card or the thickening which develops on the edge of the card after multiple readings causes an error in card advance. The ES-6019 has vacuum card advance; this solution greatly increases reliability. It also spares the cards; according to the technical description the cards can be read at least 100 times with it.

Punch card readers perform the reading in a start-stop operational mode. In multiplex operation, if the reading of a card has begun the reader sends each byte read as a column into the channel. In the event that it cannot forward the information of the column read before the reading of the next column then this information is lost. The ES-6016 has 160 bytes of buffer storage and this decreases the possibility of "information loss" to a minimum.

Card Punches

Again three types of card punches are used in Hungary, the ES-7010, the ES-7012 and the ES-7014. (The latter two types are peripherals of ES-1040 computer configurations.)

The card punches recode the information received from the channel in DK01 code into the KPK-12 code and punch it into 80 column punch cards. There is also a possibility for punching without decoding. The equipment has buffer storage; the information received from the channel first fills this and then, breaking from the channel, it does the punching. The punching is done by rows or columns with the aid of knives. (The ES equipment does not punch at one time with the block method.) The correctness of the punching is checked by comparing the read-back with the stored information.

The buffer storage of the punch card puncher is ferrite ring. Shocks arising during mechanical operation often cause errors in the buffer store (for example, breaks in wires or rings). The punching mechanism is another part of the equipment which often breaks down. Most frequently this also happens as a result of the shocks.

Data on punch card peripherals are contained in Table 1.

Punch tape peripherals are little used in large computer configurations. (The categorization of computers was done on the basis of the 1978 Computer Technology Yearbook.) The reason for this is that punch tape is not used in the IBM 360 system. So it was not used in the beginning for the ES8 machines which took over this system either. The first operational systems did not support punch tape peripherals (or did so only very clumsily) but punch tape data preparation is very wide-spread in the socialist countries for various small computers. So it became necessary to fit punch tape peripherals into the system. (It should be noted that the role of punch tape peripherals has decreased recently even for small computers as a result of the spread of flexible magnetic disc and magnetic tape data preparation equipment.) This is indicated by the fact that there is only one punch tape reader (the ES-6022) and only one punch tape punch (the ES-7022) and one punch tape station--combined reader-punch--(the ES-7902) in the selection of ES peripherals.

Punch Tape Reader

The ES-6022 punch tape reader of Soviet manufacture is a high speed, reliable piece of equipment. The ES-6022 makes possible the reading of standard 3, 6, 7 and 8 channel punch tapes by photoelectric means. The electronics of the device provides code change from the K01-7 code (semibitniy kod alya vseh informatsiy) into the DK01 code and its standard connection unit forwards the information to the channel. (It is also possible to forward information without code change.) The device has 8 bit buffer storage.

Punch Tape Punch

The ES-7022 punch tape punch of Soviet manufacture makes possible the punching of 3, 6, 7 and 8 channel punch tapes on the basis of information received from the channel. The information received from the channel is punched with code transformation (from the DK01 code to the K01-7 code) or without code transformation.

In the ES-7022 the punching mechanism breaks down most frequently, which causes omission or unevenness of the leading punch line.

Punch Tape Station

The punch tape station is a table model. It contains a punch tape reader, a punch tape punch and standard connecting units to control them, built up separately. It is also possible to build in a second reading unit

with its own controls. The several connecting units, with their mechanics, form independent units with their own addresses so they can operate simultaneously on a multiplex channel.

The ES-7902 punch tape station is of GDR manufacture and contains an ES-6122 reader and an ES-7024 punch (both of Polish manufacture).

Technical data for the punch tape peripherals are contained in Table 2.

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Table 1. Technical data on punch card peripherals

Type	Reader	Punch
ES-6012	PS-8012	ES-7012
Punch card type (columns)	45, 80	80, 90
Information code on card	KPK-12	KPK-12
Information code on channel	DK01	DK01
Card feed method	mech.	vacuum
Card punch principle	--	--
Card read principle	photoelectric	--
Punching speed, continual operation (cards per minute)	--	--
Reading speed, start-stop operation (cards per minute)	500	1,000
Number of feeders and capacity (cards)	1x1000	1x1200
Number of stackers and capacity (cards)	1x1000	2x2100
Buffer storage	no	yes
Average operational time between two breakdowns (expressed in MTBF hours)	287.2 for 80 machines	224.8 no data machines
		51.7 for one machine

Table 2. Technical data on punch tape readers

Type	Reader ES-6022	Punch ES-7022	Punch ES-7022 reader	Tape station ES-7024 punch
Tape size (—)	17.5 or 25.4	17.5 or 25.4	17.5 or 25.4	17.5 or 25.4
Number of channels	5, 6, 7, 8	5, 8	5, 6, 7, 8	5, 8
Information code on tape	K01-7	K01-7	K01-7	K01-7
Information code on channel	DK01	DK01	DK01	DK01
Reading method	photoelectric	—	photoelectric	—
Reading speed (characters per s)	1,500	—	1,000	—
Punching method	—	—	mechanical	—
Punching speed (characters/s)	—	—	150	—
Verification principle	parity	parity	parity	parity
Average operational time between two breakdowns (MTBF) expressed in hours	1048.5 for 51 machines	1061.5 for 42 machines	217.9 for 12 machines	—

INTERNATIONAL AFFAIRS

IMPROVEMENT OF WORK ORGANIZATION AT BULGARIAN COMPUTER CENTERS

Budapest SZAMITASTECHNIKA in Hungarian Mar 80 p 7

[Article by Khristo Karadzhov, candidate in technical sciences, and Dimitr Vavov, chief scientific colleague: "The Perfection of Work Organization of Computer Centers in the Bulgarian People's Republic"]

[Text] In the course of the Seventh 5-Year Plan and as a result of the national automation program we have taken new significant steps toward the automation of production and economic guidance. We established 130 new computer centers which work in every ministry and chief authority and in the larger industrial and agricultural sites and in the province centers. The technical level has improved primarily in that we are replacing second generation machines with third generation machines. The great bulk of the computers are members of the ESZR [Uniform Computer Technology System] family and this is also significant because the uniform machine park on a national scale ensures the wide-scale use of the programs developed. Experts have been educated parallel with the creation of the machine park and they are increasing their training constantly within the framework of various educational forms.

We are making no small effort to increase the utilization of the computers, as a result of which a large number of them work 24 hours a day six days a week. In the last 5 years the total operational time of the computers increased by 280 percent while the number of machines increased only two times.

The efficiency of the work of the experts, the status of technical tools and program supply and the question of quality, together with the quantitative achievements, have come into the foreground recently. Despite the fact that from the viewpoint of the national economy the direct effect of the operation of the computer centers is felt primarily by the organizations using their services the computer centers, as economic units, have a great responsibility for the perfection of their own guidance and for efficient utilization of the resources at their disposal.

As bearers of technical progress the computer center must provide an example in organization, planning and work accounting just as computer technology itself serves these goals. Improving work organization results

in increasing productivity, which opens the way for decreasing overhead and expenditures and thus decreasing the prices of the services offered by the computer center too. The new economic mechanism places high demands in regard to purposeful use of the financial resources of management units. The link between the several organizations has become more complex. Dynamic leadership requires modern and selective information and this can be organized only with the use of computer technology. This is the objective foundation for the fact that computer technology penetrates every area of life.

What are the chief points of view aimed at perfecting the operation of the computer centers?

In the first place it is necessary to clarify the structure of the computer center which is defined on the one hand by the external users and on the other by the work and mutual effects of the operating personnel, the operators, the data preparers, the system programmers, the technical service and the dispatcher groups. Standardization of the organization of the computer centers is a precondition for the standardization of work.

A second viewpoint is the preparation of detailed, standardized job descriptions and the preparation of norms connected with the number of operating personnel.

The operating regulations for a computer center consist of job descriptions for the various employees (e.g., dispatcher, operator, data base manager, system programmer, operating engineer, etc.) and the instructions for carrying out the various activities and operations (a "machine log" recording the work of the computer, a log of downtime due to technical failures, instructions pertaining to description of tasks, a list of jobs transferred to the computer center, a catalog of magnetic data carriers, regulations connected with issue, storage and accounting for magnetic data carriers, etc.).

The third essential constituent is to work out and standardize various printed forms. These include, for example, running instructions for programs issued to the computer center, other computer center service requirements (e.g., punching) and accounting records for services.

The creative character of the work of planners and programmers places special demands on the development of those printed forms aimed at consistent planning of and accounting for activity connected with the development of data processing systems. In addition to strengthening the creative character of their work one might note the accelerating process of automating the routine elements, the volume of which is constantly growing. This further facilitates standardization too. The already existing normative and methodological materials provide a good foundation for standardization and the swift development of documentation.

Resolution Number 3, 1978, of the State Committee for Scientific and Technical Development concerning planning for and the evaluation of the operation of computers represented a new step toward perfecting the guidance of the computer centers. This resolution establishes five indexes for the utilization of computers at the branch level:

- total time base,
- useful operational time,
- productive time,
- net data processing time, and
- the coefficient of intensive or extensive use.

Going beyond the branch computer centers, the rights and responsibilities of the immediate directors of individual computer centers have increased also. In 1979 there was a switch to a uniform evaluation system for the work of computers and to uniform computer technology statistical documentation.

Operational production guidance in the computer centers takes place in various time intervals. There are those based on one week and those based on 10 days. The general practice now is to divide up the machine time required according to the users; this is certainly a convenient solution but it leads to less efficient utilization of machine resources. If it also means that the programmer is present--and, naturally, this is not necessarily part of his job--then efficiency decreases further. Naturally the various types of generation and testing are exceptions to this.

The situation is better if the machine time is assigned not by user but by group of programmers. This makes possible a certain degree of guidance of the work within the group. But the question of the efficient operation of machine resources remains within the sphere of individual programmers--whose opportunities are naturally limited--and thus the level of optimization attainable is insignificant.

There can be no doubt that the most efficient method is "closed cycle" operation of the computer centers. In this case the guidance of work processes is centralized and this is an indispensable condition for all guidance. In this case the group guiding data processing has real significance and to a crucial degree the intensive utilization of the computer depends on the understanding work of this group. There can be no doubt that such a type of work organization places high demands on all users and on the computer operating personnel. On the basis of the technology available and the parameters prescribed by the users the dispatcher group does highly qualified work in compiling tasks, taking into consideration the operational schedule of the computer and the operational system being used.

The character of the services offered by the computer center is determined by ever higher demands on the planning and accounting system are made by:

- the constantly increasing number of tasks to be carried out,
- the number of users, and
- the great diversity of tasks from the viewpoint of program techniques.

The previously cited Resolution Number 3 provided for automatic accounting of work done on third and later generation computers in so-called machine units, which requires the use of "job accounting." The Job Accounting System developed by the Central Planning and Program Library in Sofia is already used for the EZR and IBM-360 computers operating under DOS and DOS POWER. The system mentioned supplements the DOS operational system in the interest of automatically assigning machine resources to tasks and developing a basis for evaluating the task. With the aid of this and with the aid of the price per machine unit determined by the Central Price Office it is possible to automatically calculate the price of processing done on the computer. With the aid of the system one can calculate the work done in the machine room in a certain time and one can obtain information pertaining to individual users, programmers, themes or tasks. The leaders of the computer center have a way to realistically evaluate and analyze the work of the personnel servicing the computer, the reliability of the mechanical devices, the work of the programmers and the utility of the existing equipment and they get help in evaluating the technological level of tasks regularly performed.

In those computer centers where they use an OS system instead of a DOS system it is also possible to record data on the resources used for a given task. This again makes possible the automation of control and accounting activities in the operation of the computer center. The joint Soviet-Bulgarian institute INTERPROGRAM developed a software product, the ORGVIC system, approved by the State Committee for Scientific and Technical Development.

One part of the system contains standards and documentation regulating contacts within the computer center. Organizational provisions regulate questions connected with work accounting and the schedule for carrying out the tasks. In practice this part of the ORGVIC solves the organizational questions standing before the personnel directly involved in the processing work of the computer center.

Another part of the ORGVIC contains a system for programs serving routine procedures which can be found frequently in the work of the computer center (e.g., magnetic tape copying, initiation, address request and archiving) and programs used in accounting for the status and operation of the computer system. Information is constantly collected in categories according to days, computers, operating systems and individual users. This provides for various types of accounting verification which covers

the computer center and the work of the individual programmers and provides information about users, the performance of tasks, the status of the magnetic data carrier library and the technical condition of the computer.

The perfection of the system has now become timely, primarily in the evaluation of work done in the remote data processing mode and in the automation of the guidance of tasks. The necessity for the latter is obvious—a high level of training, the error-free work of the "automatic dispatcher", etc. are indispensable conditions for correct guidance. The "automatic dispatcher" arranges the input tasks and starts the processing in accordance with the given operating mode. The technical characteristics of the given computer, the equipment available and working, the distribution of the operational memory, etc. represent limiting conditions. The basic parameters arising when defining the guidance algorithm are: the input time of the task, the time ratio of central unit and input/output operations, and the quantity and type of the necessary peripherals. One hardly needs to demonstrate how greatly the efficiency of the computer can be increased by such an automation of the guidance of processing.

Automatic machine accounting for such machines as the IBM 370, UNIVAC and the RC-4000 is done with the aid of products similar to the one described. In this case there is the additional task of defining a coefficient which will make possible the application of a uniform price for the service provided in terms of a uniform machine accounting unit--the so-called machine unit--independent of the type and model of computer.

Work connected with systems serving the accounting for tasks began on a national scale in the second half of 1979 in all the computer centers with modern computer technology. The mass introduction of the "job accounting system" for ESZR and IBM 360 machines took place in record time and was of great significance for the country. Naturally such a broad introduction of a new program product, which directly affects the organization of and accounting for the work of the computer center including financial relationships with users, brought a reaction from the users as a result of which new problems affecting the organization of the computer center are coming to the surface.

In the course of inspections at the computer centers it was discovered that the system makes possible an increase in the productive time of the computer, an analysis of preparation/completion operations and the performance of analyses affecting the technology used and the efficiency of the computer center. We also discovered that in some centers the technological time is impermissibly long and wastes almost half of the time intended for processing.

Technological maturity and quality can be evaluated on the basis of machine units per hour. The perfection of operational guidance and the development of optimal computer loads are very important questions. We must urgently direct the attention of the leaders and personnel of the computer centers to an improvement of the technology and organization of processing; at the present time this means doing work in the multi-programmed mode and developing understanding guidance.

Fundamental deficiencies appear in just this area. They do not keep detailed statistics on what programs are run by whom, when and how many times. The number of tasks per unit of computer time is unjustifiedly large, which points to diffuse preparatory work and a lot of wasted time.

On the other hand, there are computer centers which have "doubled" their machine resources as a result of intensive use of machine resources and the appropriate indexes are recorded. The automated accounting system for tasks makes possible an objective evaluation and comparison of computer centers. The new accounting method has proven its advantages and it must become a tool for discovering the deficiencies and reserves in the computer centers. The problem of setting norms for work done in the multi-programmed mode has been solved and we have taken an important step toward perfecting price formation for computer data processing services. By comparing processing prices and the technical parameters of individual computer types and models it has become possible to realize the principle of equal price for equal work independent of the technology used.

The accounting system broken down for individual programmers and planners makes possible an objective evaluation of their participation in the data processing process and thus makes possible differentiated wage payment for their work.

After improving the organization of and accounting for work done with computers comes the task of perfecting work connected with the development of planning systems. This will require the development and approval of standards for procedures and tasks used in the planning process. This will then orient the work of planners and programmers, standardize the documentation reflecting this activity and offer a basis for the perfection of the organization and guidance of the work.

The increased efficiency of the work of the computer centers is reflected in every branch of the national economy and justifies that increased attention which is devoted to the automation of guidance and production in the Bulgarian People's Republic.

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INTERNATIONAL AFFAIRS

STATUS OF COMPUTER TECHNOLOGY IN CZECHOSLOVAKIA

Budapest SZAMITASTECHNIKA in Hungarian Mar 80 p 9

[Unsigned article: "The Status of Computer Technology in Czechoslovakia"]

[Text] The beginning of the year is a time for evaluations, a time to sum up the achievements of the past period and define the timely tasks by analyzing the deficiencies. The evaluation of the events of last year is not yet complete so for this reason--on the basis of an article in VYBER--we selected 1978 to show the status of computer technology in Czechoslovakia. The reader will see that in many respects our situation is similar; this derives from the similarity of the possibilities.

Development

In harmony with the guiding principles of the Sixth 5-Year Plan Czechoslovakia has taken further steps toward the Uniform Computer System [ESZR] of the socialist countries in regard to both manufacturers and operators.

According to the guide provided by the 15th session of the CPCZ conditions must gradually be created to unite automated guidance systems into a single national system for information collection, processing and storage.

It can be regarded as one of the important achievements of 1978 that on the basis of a decision of the Central Committee of the CPCZ a method for evaluating the achievements of Czechoslovak economic development was worked out in detail. Attention has been directed to the quality of work done and, in parallel with this, to better utilization of computer technology too.

The cited article also placed emphasis on improving the technical base of computer technology as a basic condition for the introduction of automated information and guidance systems.

The most significant of the tasks include increased use of computer time and the replacement of data preparation machines and equipment with more modern ones. But delayed deliveries, mostly in the last quarter of the year, and deficiencies in receptivity resulted in delays in installation. Large-scale labor force migration, which continued in 1978, caused problems too.

The Computer Park

At the end of 1978 Czechoslovakia recorded 1,194 digital computers (the average storage capacity of these was over 128 K bytes), 211 punch card data processing machines, 38 [as published] process control computers, 432 [as published, but see table] hybrid computers, 432 analog computers, 417 minicomputers and 2,586 other punch card machines.

(Naturally the number of punch card machines in Czechoslovakia too is constantly decreasing; in 1978 the number of tabulators decreased from 814 to 679, the number of counter-punchers from 379 to 359 and the number of sorters from 1,669 to 1,548.)

[Untitled table]

Year	Units	Increase
1972	549	—
1973	670	121
1974	828	158
1975	1,057	229
1976	1,245	188
1977	1,582	337
1978	1,810	297

The ratio of ESZR machines is constantly increasing but it appears from statements of operators and experts dealing with AIR's [automated guidance systems] that the software provided (primarily for the ES-1021 and ES-1030 machines) and the possibilities for the further development of it do not satisfy the information system or data bank organization requirements of the AIR's. This also justifies the linking of the computers into a network as soon as possible because the unique and scattered software solutions cannot be efficient enough.

Receptivity is usually not satisfactory either when the machines are put into operation and this causes losses in utilization of the computer. Preparation for computer work is not always well planned and "lead time" is lacking. This situation was only worsened by the already mentioned "end of year rush" in deliveries.

(Computer deliveries in 1978 broke down as follows: 12.3 percent in the first quarter, 20.8 percent in the second quarter, 25.2 percent in the third quarter and 41.7 percent in the fourth quarter--22.7 percent in December.)

There are similar problems in regard to installation in the case of other computers too, in addition to the growing number of ESZR devices.

Value of Computer Technology Devices in Million Koruna

Machines and Equipment	Acquisition Price		Index
	Stocks on 1 Jan 78	Stocks on 31 Dec 78	
Total	13,272.0	16,049.4	120.9
Of this:			
data sorters	1,204.3	1,379.2	114.5
data collectors	97.7	131.0	134.1
data transmission equipment	110.6	150.4	136.0
computers	11,013.9	13,414.0	121.8
other machines	845.5	974.8	115.3

Distribution of Computers in Units

	Stocks on 31 Dec 78	Purchases in 1978
Total	1,194	153
Of these, ESZR	363	71
Of these:		
ES-1010	54	11
ES-1020	2	--
ES-1021	159	34
ES-1030	71	2
ES-1033	34	18
ES-1032	2	1
ES-1040	41	5
Socialist products	924	129
Of these, Czechoslovak	487	72
Capitalist products	270	22

The goal in regard to ESZR software is to have a broad range of user software for the new ES-1025 and other ESZR computers to be imported and to ensure program compatibility between the various types. At present the work in this area is in the stage of planning the conception.

The first minicomputers of the ESZR system were delivered in 1978 too; two SM-1 and 45 SM-3 minicomputers were put into operation. The Robotron 1840 and the Robotron 1750, manufactured in the GDR, expanded the variety of minicomputers. Czechoslovakia also manufactures minicomputers--the ADT-4300 and ADT-4100 equipment. More new machines are needed because of the 2,005 computers surveyed 539 are considered physically and morally obsolete (more than 8 years old) and 408 are suffering moral attrition (more than 5 years old).

Distribution of Computers by Age and Type on 31 December 1978

Computer Type, according to Czechoslovak categorization	Total (units)	By age (units)			Average age in years
		0-5	5-8	Over 8	
Punch card	211	34	81	96	8.3
Digital, total	1,194	767	241	186	4.9
Of these:					
Small (up to 256 K bytes)	185	100	56	29	5.5
Medium I (up to 512 K bytes)	523	319	102	102	5.2
Medium II (up to 1,024 K bytes)	245	148	59	38	5.0
Large (above 1,024 K bytes)	241	200	24	17	3.8
Process control	161	136	18	7	3.6
Hybrid	7	7	--	--	3.5
Analog	432	159	68	205	7.6
Total	2,005	1,103	408	539	5.5

As can be seen from the table the average age of the digital computers is 4.9 years, that of punch card computers is 8.3 years, that of process control computers is 3.6 years and that of analog computers is 7.6 years.

The replacement of computers more than 8 years old with second generation computers has become timely and in the near future they must replace the 22 MINSK computers, which average 12 years old.

Data Preparation and Data Collection Equipment

Their number reached 19,300 in 1978 and the number of operators working in the equipment reached 10,867. These include--among others--10,824 punch card, 7,776 punch tape and 131 multi-position magnetic tape and magnetic disc data recording devices.

As can be seen from this listing the classical punch card and punch tape technology retains its advantage; the use of these machines comes to 60.66 percent of the single shift capacity. Use of the group magnetic data recording devices comes to 13.6 percent in general and the use of each position averages 9.0 percent. Even single position magnetic data recording devices are better used than the punch card equipment.

The use of modern machines is improving but it could be improved further if the shortage of manpower could be eliminated and if there were more careful preparation for operation of the equipment, from both the technical and organizational point of view. Time use can increase only in this way.

In the final analysis the backwardness appearing in data preparation has an effect on the use of the computers too.

The renewal of the data preparation machine park is going at a much slower pace than the development achieved in the area of computers would require.

Use of Computers

The survey of computer time use also showed that computers were used most efficiently by those users who had their own separate computer technology organization.

There were 260 working days in 1978 so the time capacity (two shift operation with a five day work week) of one computer was 4,160 hours. The punch card equipment was operated for 3,766 hours; the small computers (up to 263 K bytes) were operated for 2,605 hours; the medium computers (up to 312 K bytes) were operated for 3,725 hours; the medium II computers (up to 1,074 K bytes) were operated for 4,197 hours and the large computers (above 1,024 K bytes) were operated for 4,602 hours.

But the number of operating hours serves only for orientation. In judging computers what is important is the ratio of productive work and lost time since the testing time and the program checking work counts as productive time.

The following table shows the distribution, in percent, of computer time use.

Computer type	Punch card		Small		Medium I		Medium II		Large	
	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978
Productive work	76.1	74.5	77.0	75.1	75.1	75.6	73.1	73.7	71.5	72.6
Testing	2.3	1.8	15.1	15.9	12.5	12.2	10.4	9.9	20.8	19.4
Breakdowns	7.9	7.6	5.6	6.0	5.9	5.0	6.4	5.6	7.6	6.7
Down-time	7.3	8.8	7.4	8.5	5.9	6.4	6.0	6.5	5.9	6.2

The Expert Base

Among the various areas of computer technology it is most difficult to provide experts for data preparation and data collection. The least interest is shown in servicing the classical punch card and punch tape equipment.

One survey cast light on another reason too, namely the fact that in many cases the modernization of the wage system plays a role in manpower fluctuation because it simply does not take into consideration the professional composition of the computer centers.

The following fundamental measures would be needed in the interest of improving the situation:

- give advantages to those working on the second or third shift (in pay and in social allotments),
- modernize the data preparation equipment, and
- introduce a school system which gives computer technology training.

But there is not yet even a national conception in Czechoslovakia for a reassuring solution to these problems.

With the performance of demanding tasks the training level of those working in computer technology is going ever higher.

In 1978 there were 55,730 people working in various areas of computer technology (52,797 in 1977). The ratio of those who had graduated from university or college was 21.9 percent in 1978 (20.6 percent in 1977).

Development of the Training Level of Those Working in the Profession

	Level of Schooling		
	Higher	Secondary	Other
1972	11.9	39.0	49.1
1973	13.9	39.2	46.9
1974	15.2	40.0	44.8
1975	16.9	41.0	42.1
1976	19.1	42.7	38.2
1977	20.6	42.9	36.5
1978	21.9	43.6	34.5

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BRIEFS

HEALTH COOPERATION--On 30 May 1980, the "Protocol and Thematic Plan for Scientific Cooperation" in medical sciences during 1981-1985 was signed between the Czechoslovak Academy of Sciences and the USSR Academy of Medical Sciences, in Prague. The agreement stipulates extended cooperation in the field of viral and molecular biology, immunology, infectious pathology, as well as other areas of medicine. [Prague PRACE in Czech 31 May 80 p 2]

CSO: 2402

SPACE RESEARCH, DEVELOPMENT, PROGRESS DESCRIBED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 1, 1980 pp 44-48

[Article by Senior Scientific Associate Stefan Chapkunov: "Bulgarian Scientific Space Instrument Making"]

[Text] The Bulgarian People's Republic began active work on staging scientific space experiments with its own apparatus in 1969 when the Central Space Research Laboratory (CSRL) of the Bulgarian Academy of Sciences was set up. The then director, the unforgettable Academician L. Krustanov, together with the present CSRL director, Corresponding Member K. Serafimov, implemented the idea of creating a specialized instrument-making production unit. The latter's function was to start the job, novel for Bulgaria, of creating Bulgarian scientific instruments for directly conducting space experiments in the Intercosmos program. This production unit was headed up by Senior Scientific Associate St. Chapkunov.

In close collaboration with the Ionospheric Research Laboratory, directed by State Prize Laureate Prof. K. I. Gringauz and constituting part of the Space Research Institute in Moscow, the CSRL instrument-making team, small in number and young, in record time for then developed a combined electronic device for conducting fundamental ionospheric research from on board an artificial earth satellite. This small instrument, called the P-1, traveled on board the artificial earth satellite Intercosmos-8, launched on 1 December (the first "purely" ionospheric satellite in the Intercosmos program). The fact of the faultless operation of the first Bulgarian instrument, the P-1, for measuring electron concentrations and temperatures by means of a Langmuir cylindrical sonde (Soviet construction) and ionic plasma characteristics by means of two three-electrode spherical ion traps (also of Soviet make) made the Bulgarian People's Republic the eighteenth space power in the world.

Scientific space instrument making was developed intensely in our country from 1972 to 1977. As a result of this development, numerous satellite and rocket experiments were conducted in the Intercosmos program (artificial earth satellite Intercosmos-12, Intercosmos-19, heavy geophysical

rockets Vertical-3, Vertical-4, Vertical-6 and Vertical-7), as well as objects in the national program (meteorological rockets Centaur-II-48 and Centaur-II-50—a joint Bulgarian-Indian experiment).

On the basis of the rich experience in space instrument making in Bulgaria, the CSRL was able to give thought to establishing a well-grounded and extensive scientific program which will be carried out by the first Bulgarian cosmonaut, now in training for the flight. The BCP Central Committee and the Council of Ministers of the Bulgarian People's Republic have assigned to the National Space Research and Utilization Committee and, chiefly, its main agent—the CSRL—the important task of designing and producing in unprecedentedly short time, the original Bulgarian apparatus with which the pilot-cosmonaut Major Georgi Ivanov will make measurements in terrestrial space on board the orbital station Salyut-6. The Bulgarian scientific program for the first Bulgarian cosmonaut is based, of course, on the Bulgarian experiments already conducted by means of ground and space facilities. The scientists at the Bulgarian Academy of Sciences have approached this important task creatively. Thus, three months before the historic flight of the Soyuz-33 ship with a crew consisting of Rukavishnikov and Ivanov, there arrived at the Cosmonaut Training Center near Moscow the newly developed Bulgarian instruments and systems with which measurements on board the Salyut-6 were to be made in keeping with the Bulgarian amended scientific program.

As is known, the first Bulgarian complex of scientific instrumentation burned up in the instrument compartment of the Soyuz-33 ship which, due to damage to its main engine, was unable to dock with the Salyut-6 station. For all that, the Bulgarian instrumentation (the second flight set) arrived at its destination and the entire scientific program was accomplished by loading the Lyakhov-Ryumin crew additionally on the Salyut-6. Two months ago an official Bulgarian delegation at the Intercosmos Space Research and Utilization Council in Moscow received cassettes with recordings of the Bulgarian scientific experiments, ampoules from the technological experiments, and the gratitude of the Soviet scientific community for the high scientific and applied values of the Bulgarian scientific program.

Since 1972 the CSRL has conducted precisely targeted investigations of natural atmospheric optical emissions (the CSRL Base Observatory at Stara Zagora—director: Senior Scientific Associate M. Gogoshev—is a pioneer in these investigations on a national scale), and since 1976 has also conducted investigations directly from on board heavy geophysical rockets, meteorological rockets and artificial earth satellites.

Instruments of the EMD-P1, EMD-1 etc. type have flown and proved their merits, serving as the basis for the development of the Duga [Arc] optical system that was created specifically for the research of a manned station of the Salyut type.

At the 1978 COSPAR [Committee on Space Research] session in Innsbruck the delegates (among whom were two Bulgarians) heard with interest the report of cosmonauts Romanenko and Grechko, who at that time held the record for having worked the longest under conditions of weightlessness on board the veteran Salyut-6 station. A discovery was reported that sounded strange to the scientists: during the 96-day flight of the two cosmonauts, luminous regions were observed at altitudes of 200-500 km above the geomagnetic equator. The cosmonauts visually determined the intensity of these phenomena and characterized them as "luminous arcs." In a talk among Corresponding Member K. Serafimov, Senior Scientific Associate M. Gogoshev, the two cosmonauts, and the director of the Space Research Institute of the USSR Academy of Sciences R. Z. Sagdeev a new and original scientific mission was formulated in one night, namely, the investigation of these equatorial arcs by means of Bulgarian electrophotometric apparatus. Thus was born the idea of creating the Duga apparatus, an idea that was put into effect in an extremely short time.

In brief, the Duga apparatus has the following working principle: an optomechanical unit that serves to receive, guide and register the light energy striking the input of the telescopic system; and a recording system making possible the amplification, forming and recording of the light energy converted into an electric signal.

The Duga electrophotometer is designed on the basis of the use of a Cassegrain-type telescopic system with a sight, intended for visual aiming of the basic telescope, mounted parallel to the optical axis of the system. The light flux is collimated and fed into a system consisting of four rotating filters. The individual filters separate individual lines of the visible light spectrum, which consecutively attack a photoelectronic multiplier. The latter serves as a photocconverter of light energy into electric energy. Measurements are made in four bands (spectral lines) of the visible light spectrum. Analysis of the results is based on the procedure created by Senior Scientific Associate M. Gogoshev and known as the "two-filter method," which consists in measuring the respective light fluxes passing through a filter positioned perpendicularly to the optic axis of the system, and in comparing the fluxes that pass through the same filter in an inclined position vis-a-vis the optic axis. Information is recorded on magnetic tape by a cassette recorder specially suited for the particular case. The Duga instrument is an original design and its merits are attested by the appraisals of the Soviet state commission that accepted the Bulgarian apparatus: "The transceiver tests showed that the Duga apparatus has been developed taking into account the latest achievements in the field of scientific instrument-making. In its fundamental characteristics (sensitivity and spatial separation) the apparatus surpasses the best models of apparatuses of analogous purpose used in space research. It is unique and makes it possible to obtain new scientific data on the physics of phenomena in the earth's ionosphere and magnetosphere."

Although some particular questions of remote aerospace methods for earth research have been under development for a long time in our country, these methods received complete and all-round development in the past few years when a social problem group was set up at the CSRL of the Bulgarian Academy of Sciences. This group has begun to implement the possibility of applying and effectively utilizing remote methods for purposes of the ecology and national economy. In 1975 a new standing study group on "Remote Aerospace Methods of Earth Research" was set up within the framework of the Intercosmos program. The Bulgarian People's Republic was one of the initiators.

Scientific-research and design-and-planning work in our country is developing along two lines: development of methods and means for the use of aerospace-photographic data and the design of measuring instrumentation. To make possible the unequivocal identification of different natural formations recorded as photo and television images obtained by aerospace equipment, instruments have been developed to measure the spectral reflection characteristics of various natural formations. The ISOKh [izmerivatel na spektralnite otrazhatelni kharakteristiki; instrument to measure spectral reflection characteristics]-010 and ISOKh-020 instruments of Bulgarian make are respectively the second and third modification of the instrument series making possible the consecutive measurement of spectral reflection characteristics. This series is highly rated due to the use of a semiconductor charge-storage phototransducer (original Bulgarian invention). The optical system is mounted directly in front of the photoelectronic converter, thus reducing the dimensions of the instruments. These instruments can operate not only under ground measurement conditions, but also on board an aircraft or space device. Comprehensive tests of the instruments have confirmed their high qualities. Instruments of the ISOKh type have been used in comprehensive aircraft, ground and satellite experiments conducted not only on Bulgarian territory, but also in the USSR, Czechoslovakia, Poland and Mongolia. Since 1976 an analogous instrument has been in operation on the firing grounds of the Republic of Cuba.

On the basis of these instruments a space version of Spectrum-15 was developed that has operated successfully on board the Salyut-6 station. The Spectrum-15 applies the latest achievements of modern photographic technology and electronics. The photoelectronic converter is replaced by a light-converting bar composed of 15 electric-charge-storage phototransistors.

The Spectrum-15 instrument consists of two units: the Spectrum-15 K and Spectrum-15 ER. The Spectrum-15 K is a 15-channel spectrometer operating in the 450-950 nanometer range. With an appropriate lens the solar radiation or investigated body's own radiation reflected from the earth's surface or from a space object under study is fed into a diffraction grating, after which the spectral components constituting it are obtained. The Bulgarian diffraction grating is original and was developed at the Central Laboratory for Optical Information-Recording of the Bulgarian Academy of

Sciences. After the diffraction grating the signals strike the end surface of the semiconductor photoconverter which converts the light energy into electric energy. Each phototransistor converts the light on only the specified strip of the spectral object under investigation. The light energy converted into electric energy by each phototransistor is fed consecutively in time into the electronic scanning device for further processing. This device makes it possible to obtain a great number of spectrograms per unit time. The second unit, the Spectrum-15 KR, is a device for recording in digital form on magnetic tape the data obtained from the multichannel spectrometer, and simultaneously it controls the operation of the entire apparatus. Measurement of the electric energy corresponding to each spectral channel is effected by means of an analog-to-digital converter. The obtained values are recorded by a special digital cassette recorder at a high rate of registration. The cassette recorder is the principal part of the Spectrum-15 KR unit. A complex electronic device controls its operation and synchronizes the functioning of all the other units. In addition to digital data from spectral measurements, the capability is provided of recording, likewise in digital form, the spoken information with which the research cosmonaut accompanies his performance of a given investigation. The recording time per cassette suffices completely to investigate a strip of the earth's surface 350 m wide and over 3000 km long. The cassettes with the information recorded on their magnetic tape return to earth together with the cosmonaut and the data are processed by electronic computer.

The principal measurements with the Spectrum-15 instrument are made when the objective of the spectrometer is turned towards the "nadir" (center of the earth). For the purpose use is made of an appropriately oriented illuminator of the satellite, with the spectrometer mounted on a special stand. The design of the apparatus also permits operation with the spectrometer by manual aiming when space objects or phenomena have to be investigated. In this event the spectrometer is aimed correctly with an optical sight.

The design of the Spectrum-15 instrument takes into account all the necessary specific requirements of space flight: small geometric dimensions, light weight, stability under overloads, low power consumption, operational reliability under conditions of weightlessness etc. The data obtained with the apparatus can be used comprehensively for purposes of science and the national economy both independently and also in combination with data recorded by the MKF-6 camera.

At the moment the CSRL is implementing the great scientific project "Bulgaria -1300." Scientific apparatus is being developed in a short time, including apparatus for space experiments not hitherto conducted. The special space facilities, used for the first time in the Intercosmos program, will be supplied entirely with Bulgarian scientific equipment. The execution of this well-grounded scientific project will confirm the CSRL's reputation as a scientific production unit with world fame in the investigation of near space with its own scientific apparatus.

BRIEFS

PLANNED INTERFERON PRODUCTION--According to Istvan Bihar, director of the United Pharmaceutical and Nutriment Factory [Egyesult Gyogyszer es Tapszergyar], research into the production of Interferon will be an essential research topic of the factory and will be approached from many angles. The factory is dealing with Interferon as part of the immunopharmacology program; its goal is to realize production of this substance within 1 or 2 years. Collaborators in the work include the Microbiological Institute of Szeged Medical University, which evolved a procedure for extracting Interferon from human leukocytes, and the National Institute of Hematology and Blood Transfusion. The minimal program for this year is to evolve a reliable, reproducible technology on the basis of which Interferon of purity in conformance to U.S. standards can be made. Regular production and sales are scheduled to begin in 1981. It is too soon to say what the future use of the substance will be in Hungary since such experiments have not been conducted there yet. At all events, the factory is prepared to make it available for use in Hungary. [Budapest NEPSZAVA in Hungarian 18 May 80 p 4]

CSO: 2502

ROMANIA

FIRST ROMANIAN EXPEDITION TO ATLANTIC ANTARCTIC REPORTED

Bucharest ROMANIA LIBERA in Romanian 29 May 80 p 5

[Article by Ion Popovici: "The First Romanian Expedition to the Antarctic Region of the Atlantic Ocean"]

[Excerpts] The members of the team of researchers from the Romanian Institute for Marine Research in Constanta, who participated in an expedition to the Antarctic region of the Atlantic Ocean, returned to the country recently. We requested a short interview with the head of the collective of researchers, Dr Eng Stefan Parcalaboiu.

[Question] What was the purpose of this expedition?

[Answer] To study fish resources. All the countries which keep the option of exploiting the oceans outside of their territorial waters for fishing purposes are interested in finding new regions adaptable for fishing and in achieving adequate exploitation and processing technologies. This is why our country is actively participating in international collaboration in the realm of ocean fishing research. Therefore, the expedition which we concluded recently is in the framework of the cooperation plan of the countries participating in the maritime fishing agreement.

[Question] Is this the first time that Romanian researchers have explored the ocean space?

[Answer] Two years ago another collective from the Romanian Institute for Marine Research carried out research in the area of South America, on the vessel "Sinoe." However, this is the first time that research has been undertaken, with a Romanian vessel, in the Antarctic region of the Atlantic Ocean.

[Question] What can you tell us about the schedule of the expedition?

[Answer] The expedition lasted almost 50 days, with departure from the Angolan port of Luanda at the beginning of February. The trip was made

with a ship from our ocean fishing fleet, the trawler "Tirnava," commanded by long-haul Captain Dumitru Moraru. The voyage went up to the 56th south latitude parallel, a zone covered by floating icebergs and ravaged by bad storms. The expedition proposed as priority objectives: the determination of the space distribution and of the density of exploitable resources, the perfecting of the technologies of construction and utilization of trawlers, as well as the devising of technologies for the best possible processing of fish resources. For this purpose, various projects were executed such as: meteorological observations, drill fishing, collection and preservation of materials for the collections of our institute, technical experimentation of some new fishing tools, infrared observations and photographs for correlation with satellite observations, etc.

A number of important elements were established for the purpose of working out the construction and use of trawlers for krill fishing. The krill is of interest, especially, for fodder since there is no need for supplementary investments. In regard to human consumption, continuing research, with proper apparatus, is required.

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